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Publication date:
2005

CentER

Discussion Paper

No. 2005–16

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January 2005

ISSN 0924-7815

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Ecstasy and cocaine; patterns of use among prime age individuals in Amsterdam

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Abstract

This paper uses information about prime age individuals living in Amsterdam to study the patterns of use of ecstasy and cocaine. The information was collected in surveys in 1994, 1997 and 2001. The analysis shows that the use of ecstasy and cocaine is mainly influenced by calendar year, family situation, and parental cannabis use. Individuals that are more likely to use cocaine are also more likely to use ecstacy. Whether or not an individual starts using ecstasy or cocaine is highly age dependent, i.e. it usually happens between age 20 and 35. If an individual has not used at age 35 he or she is very unlikely to do so at a later age. The entrance of ecstasy in the Amsterdam drugs market in the course of the 1990s did not reduce the use of cocaine.

JEL codes: D12, I19

Keywords: ecstasy; cocaine; patterns of use

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1 Introduction

Ecstacy, XTC, or methylenedioxymethamphetamine (MDMA) is a relatively new drug. Ecstasy was synthesized and patented in 1914, but was never marketed. After its re-discovery in the USA in the late 1970s, its capacity to create empathy and facilitate interpersonal communication were put to use in psychiatry. In the mid-1980s ecstasy became popular in the USA among the general population and later on in Europe (United Nations, 2004). Cocaine is an old drug derived from the coca leaf, which was already used by the south American Incas. In the 19th century cocaine was discovered to be the substance responsible for the stimulating effects of coca leaf use. Worldwide consumption of ecstasy has increased in the course of the 1990s and now in many countries the levels of use of ecstacy and cocaine are very similar while in some countries the use of ecstacy even exceeds the use of cocaine. At the start of the twenty-first century ecstacy use among the population of (approximately) 12 years and older was 2.0% in the UK, 1.5% in the Netherlands, 1.3% in the US and 3.4% in Australia. For cocaine use the numbers were 2.1% in the UK, 1.1% in the Netherlands, 2.5% in the US and 1.3% in Australia (United Nations, 2004).[1]

The Netherlands has a drugs policy that distinguishes hard drugs from soft drugs. The distinction relates to the health risks involved in drug use. Hard drugs are those substances which can seriously harm the health of the user and include heroin and cocaine. Soft drugs, i.e. cannabis derivatives marijuana and hashish cause far fewer health problems. The possession of a small quantity of soft drugs for personal use is no offence. However, the possession of hard drugs is a crime. Ecstasy was put on the list of hard drugs in 1988. Within the Netherlands it is especially the capital Amsterdam that has a reputation as a drug users city. In 2001 of the Amsterdam population of 12 years and older lifetime prevalence was 8.7% for ecstasy and

[1]Note that drug use is defined as last year prevalence.

10.0% for cocaine. Average for the Netherlands this was 2.9% for both ecstasy and cocaine (Abraham et al., 2003). Information about recent use of a number of selected drugs among inhabitants of 12 years and older in Amsterdam is presented in Table 1. As shown cannabis is by far the most popular while only few individuals use amphetamines and heroin. Table 1 also shows that recent use increased for all types of drugs with the increase in the use of ecstasy being by far the largest. In the course of the 1990s ecstasy use reached a level comparable to that of cocaine. In 2001 2.8% of the Amsterdam population of 12 years and older used cocaine, while 3.6% used ecstasy. The mean age of first use was 24.9 years for cocaine and 25.9 years for ecstasy.

The current paper presents an empirical analysis of ecstasy use and cocaine use based on 1994, 1997 and 2001 drug use surveys among inhabitants of Amsterdam. The contribution to the literature is twofold. First, it presents an analysis of the determinants of ecstasy use about which not much is known. Previous studies are often based on samples of ecstasy users of which the representativeness is not clear. Degenhardt et al. (2004) is one of the rare representative studies, based on an Australian household survey. The study reports that Australian ecstasy users are more likely to be young, male and students than their counterparts. There is a correlation between ecstasy use and the use of alcohol, cannabis, amphetamines, and cocaine. A UK study among polydrug users indicates that cocaine and ecstasy are substitutes, indicating that they have a shared function as social facilitators and enhancers of positive mood (Sumnall et al., 2004). The second contribution of the current paper to the literature is that it investigates the demand relationship between ecstacy and cocaine. The introduction of ecstasy in the Amsterdam drugs market in the course of the 1990s reads as a small scale experiment which is used to identify whether ecstasy use crowed out cocaine use.

2 Method

2.1 The data

The drug use data used in the analysis are collected by CEDRO, the Center for Drug Research of the University of Amsterdam in 1994, 1997 and 2001 (see Abraham et al. (2003) for a detailed description). The survey population is defined as all persons in the Municipal Population Registry of Amsterdam. There are some differences between the surveys, but the information used in this paper is collected consistent through time. In 1994 two interview methods were used, a written and a computer assisted version (using laptop computers where the interviewer directly typed in the answers). The sample was randomly subdivided into two equal sized samples. It turns out that the interview method did not affect the answers to the questions. The 1997 survey was fully computer assisted. The 2001 survey was based on a mixture of methods. Respondents could choose between a paper questionnaire, a computer assisted face-to-face interview, an interview per telephone, via their own computer on the Internet or on a compute disk (floppy disk by mail). The non-response in 1994 was 49.2%, in 1997 48.1%, and in 2001 60.9%.

The focus of the paper is on prime age individuals, i.e. individuals aged 26 to 50 years. Because some studies find individuals from ethnic minority groups to underreport drug consumption individuals not born in the Netherlands or without a Dutch nationality are omitted. After removing observations with incomplete information the net sample contains 2288 prime age females and 2038 prime age males.

2.2 Measures

The questions about the use of ecstacy and cocaine are based on questions concerning last year prevalence. The explanatory variables are the following. *Age*: Age of individuals at

the time of the survey. In the estimates dummy variables for particular age groups are used. *Secondary education*: Dummy variable with a value of 1 if the individual attended secondary general or vocational education, and a value of 0 otherwise. Secondary education refers to intermediate vocational or secondary general education. *Higher education*: Dummy variable with a value of 1 if the individual attended higher vocational or academic education, and a value of 0 otherwise. Since there are two dummy variables for education the overall reference group consists of individuals with lower education. *Single*: Dummy variable with a value of 1 if the individual is living alone and a value of 0 if the individual is part of a multi-adult household. *Children*: Dummy variable with a value of 1 if the individual has children and a value of 0 otherwise. *Year 1997 (Year 2001)*: Dummy variable with a value of 1 if the individual participated in the survey of 1997 (2001) and a value of 0 otherwise. *Cannabis use parents*: Dummy variable with a value of 1 if one or both parents have ever used cannabis and a value 0 otherwise.

The description below of the relationship between age and lifetime use is based on the *age of onset of ecstacy use (cocaine use)*, which was collected by asking individuals that indicated previous use of ecstacy (cocaine): "At what age did you start using ecstacy (cocaine)?"

2.3 Statistical analysis

The statistical analysis concerns the determinants of use of ecstacy and cocaine. In the analysis y_j is an indicator of whether ($y_j = 1$) or not ($y_j = 0$) an individual uses ecstasy ($j = a$) or cocaine ($j = b$). A latent variable specification is used to represent the individual's unobserved propensity to be an ecstasy or cocaine user: $y_j^*{=}x\beta_j + \varepsilon_j$, where, $y_j = 1$ if $y_j^* > 0$, and 0 otherwise. Furthermore, x is a vector of personal characteristics affecting the probability to be an ecstasy or cocaine user, the β_j are vectors of parameters, and ε_j are error terms.

The modelling has to take account of the possibility that there is a correlation between ec-

stasy use and cocaine use through unobserved determinants. One can imagine that conditional on their observed characteristics there are individuals that have an inclination towards drug use. Then there is a positive correlation between ecstasy use and cocaine use. It could also be that individuals prefer one drug to the other. Then, conditional on the observed personal characteristics there is a negative correlation between the error terms ε_a and ε_b.

To account for the correlation between the error terms a bivariate probit specification is used. The contribution to the likelihood of individuals that use both ecstasy and cocaine is $\Phi_2(x\beta_a, x\beta_b; \rho)$, where Φ_2 refers to a bivariate probit specification and ρ represents the correlation between the two error terms. The other combinations of use and non-use are specified equivalently.

3 Results

Table 2 presents the combinations of use of ecstasy and cocaine, distinguishing between lifetime use and recent use (last year prevalence). As shown the share of individuals that never used ecstasy or cocaine declined in the course of the 1990s. Males have a have lifetime use of ecstacy and cocaine than females. The increase in ecstasy use occurred both separate from cocaine use and joint with cocaine use. The share of individuals that previously used cocaine but no ecstacy decreased somewhat. Total lifetime use of ecstasy increased a lot in the period 1994-2001 but for both males and females it is still smaller than lifetime use of cocaine.

Males are more likely to use ecstasy and cocaine than females. There is an increase over time in joint use ecstasy and cocaine and separate use of ecstasy. Since 1997 for both males and females there is more use of ecstacy than cocaine. Clearly, Table 2 shows that the introduction of ecstasy led some cocaine users to adopt ecstasy in their drug consumption pattern. But, there are also ecstasy users that previously never used cocaine.

Based on information about the age of onset one can derive for each cohort the relationship between lifetime prevalence of a particular drug and age (see Van Ours (2003) for details). Figures 1 and 2 give a graphical representation of this relationship. Figure 1a shows that females start using cocaine from age 15 onwards. If females have not started using cocaine at age 35 they are not very likely to do so at a higher age. Lifetime prevalence of cocaine has increased among females in the course of the 1990s. Whereas the lifetime prevalence among females beyond age 35 was about 12% in 1994, it was about 14% in 1997 and about 15% in 2001. Figure 1b shows that for females the increase in lifetime use of ecstasy has been quite spectacular. Whereas ecstasy lifetime prevalence among females beyond age 35 was about 4% in 1994, it was about 10% in 1997 and about 14% in 2001. Clearly the introduction of ecstasy in the Amsterdam drugs market has affected the behavior of females but there is no indication that this was at the expense of cocaine use. In 2001 the relationship between lifetime prevalence and age of females was were similar for ecstacy and cocaine. Figures 2a and 2b show similar patterns for the lifetime use of ecstacy and cocaine for males. The main difference with females is that for males the curves level off at higher prevalence rates than for females. Whereas in 2001 lifetime prevalence for females was maximum about 14-15% for both cocaine and ecstasy it was 20-22% for males. Also for males the curve for cocaine shifted upwards indicating that at a given age lifetime prevalence of cocaine was higher in 2001 than in 1997 and 1994. For ecstasy there was also a shift of curves but the difference between 1997 and 2001 is not that big. This indicates that males where earlier to adopt ecstacy than females.

The maximum likelihood parameter estimates of the bivariate probit model are presented in Table 3. The estimates are done separately for males and females. For females ecstasy use is significantly higher in 1997 than it was in 1994. Furthermore, ecstacy use declines with age, is independent of education, higher among single females, females without children and females with parental cannabis use. Cocaine use among females is stable over time, is not dependent

on age and education, and higher among single females and females with parental cannabis use. The signs of the estimated parameters are usually identical, and they are always identical if the parameter estimates differ significantly from zero. At the level of the individual this generates a positive correlation in the use of ecstasy and cocaine. By and large the parameter estimates are similar for males, with the main exception of cocaine use that increased in the course of the 1990s. For both males and females conditional on the observed characteristics there is positive correlation between the error terms of ecstasy use and cocaine use. Apparently both types of use are influenced by similar unobserved personal characteristics. All in all, at the level of the individual ecstasy use and cocaine use are positively correlated both through observed and unobserved characteristics. The parameter estimates of the calendar time effects do not suggest that ecstasy use crowded out cocaine use.

4 Discussion

To give an idea about the magnitude of the effects of the personal characteristics Table 4 presents some simulation results based on the parameter estimates of Table 3. For different types of individuals ecstasy use and cocaine use are predicted. The reference person is in year 1994, age 30, with lower education, is non-single, has no children, and no cannabis use of the parents. As shown of the group of reference females 0.6% used ecstacy, and 1.1% used cocaine. For males these numbers are 2.6% for ecstacy and 3.2% for cocaine. Clearly, conditional on their personal characteristics ecstacy use and cocaine use among males are substantially higher than among females. The second row of Table 4 shows drug use of the same individuals group of individuals but now in 2001 instead of 1994. The effect of calendar time is very important. Ecstacy use increased to 2.8% among the females of the group and to 6.1% among the males of the group. Concerning cocaine use there is no calendar time effect for females while for males

there is an increase from 3.2% to 5.6%. Again, it is clear that there is no crowding out. What is not clear is why ecstasy use increased so much in Amsterdam in the course of the 1990s. It could have to do with increased availability or with a decrease in prices (Note that Sumnall et al. (2004) conclude that consumption of ecstasy and cocaine are both very sensitive to price changes).

The effects of age are not that large. If the reference individuals had been of age 40 instead of age 30 their ecstasy use would have been somewhat smaller and their cocaine use would have been somewhat larger. Given the cross-sectional nature of the data it is not possible to distinguish true age effects from cohort effects. However in view of the big calendar time effects the cohort effect is most likely the dominant explanation for the negative age effect. For older individuals ecstasy was introduced 'too late' to be adopted in the drug use habits. The effects of being single are quite substantial. Single females have a probability of ecstacy use that is three times as high as females with a partner. For cocaine singles have a probability of use that is twice as high. For single males the probability of ecstacy use is 50% higher than for males with a partner while cocaine use is about twice as high. For both males and females the presence of children reduces the probability of ecstacy use and cocaine use substantially. Finally, the effects of parental cannabis use are very large. Females with parents that used cannabis are five times more likely to use ecstacy and six times more likely to use cocaine than their counterparts. For males with parents that used cannabis the effects on ecstasy use are similar while the effects on cocaine use are somewhat less spectacular. Males with parents that used cannabis are 'only' three times more likely to use cocaine than their counterparts.

In conclusion, the analysis shows that ecstasy use is influenced by the same personal characteristics as cocaine use i.e. by sex, marital status, presence of children, parental cannabis use, and calendar year. Males, single individuals, individuals with children, and individuals of which the parents used cannabis are more likely to use ecstacy and cocaine than their counterparts.

In addition to the correlation through observed characteristics there is a positive correlation through unobserved characteristics. Conditional on their observed characteristics, individuals that are more likely to use ecstasy are also more likely to use cocaine. The adoption of both ecstasy and cocaine in the pattern of drug use is very age specific. If individuals have not started to use at age 35 they are very unlikely to do so at a later age. Finally, although in the course of the 1990s ecstacy use increased substantially this occurred not at the expense of cocaine use.

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Table 1 Drug use in Amsterdam, mean age of first use; selected drugs[a)]

	Drug use (%)					Mean age
	1987	1990	1994	1997	2001	first use
Cannabis	9.5	10.2	11.2	13.2	13.1	19.9
Cocaine	1.6	1.3	1.9	2.6	2.8	24.9
Ecstasy	-	0.7	1.6	3.2	3.6	25.9
Amphetamines	0.6	0.5	0.5	0.9	1.1	22.7
Heroin	0.3	0.1	0.2	0.4	0.7	23.7

[a)] Population of 12 years and older; drug use refers to last year prevalence; mean age of first use in 2001 (for heroin in 1997)

Source: Abraham et al. (2003)

Table 2 Lifetime use and recent use of ecstasy and cocaine (%)[a)]

		Females			Males		
Ecstasy	Cocaine	1994	1997	2001	1994	1997	2001
Lifetime use							
No	No	88.0	84.2	80.8	82.8	77.2	77.1
Yes	No	1.2	3.3	5.1	2.3	3.3	4.8
No	Yes	8.5	8.1	7.1	10.9	9.0	8.4
Yes	Yes	2.3	4.5	7.0	4.0	10.5	9.7
Total		100.0	100.0	100.0	100.0	100.0	100.0
Total lifetime use							
Ecstasy		3.5	7.8	12.1	6.3	13.8	14.5
Cocaine		10.8	12.6	14.1	14.9	19.5	18.1
Recent use							
No	No	97.3	95.9	94.6	95.4	90.6	91.5
Yes	No	0.5	2.0	2.6	1.8	3.7	3.4
No	Yes	1.8	0.8	1.1	2.0	2.2	2.5
Yes	Yes	0.4	1.3	1.7	0.8	3.5	2.6
Total		100.0	100.0	100.0	100.0	100.0	100.0
Total recent use							
Ecstasy		0.9	3.3	4.3	2.6	7.2	6.0
Cocaine		2.2	2.1	2.8	2.8	5.7	5.1

[a)] Individuals 26-50 years; sample of 2288 females and 2038 males.

Table 3 Parameter estimates bivariate probit models[a)]

	Females		Males	
	Ecstasy	Cocaine	Ecstasy	Cocaine
Year 1997	0.51 (3.0)*	-0.10 (0.7)	0.45 (3.6)*	0.31 (2.4)*
Year 2001	0.63 (3.9)*	0.03 (0.2)	0.40 (3.2)*	0.26 (2.1)*
Age 31-35	-0.00 (0.0)	0.21 (1.3)	-0.08 (0.6)	0.06 (0.4)
Age 36-40	-0.45 (2.3)*	0.05 (0.3)	-0.07 (0.5)	0.07 (0.5)
Age 41-50	-0.74 (3.8)*	-0.02 (0.1)	-0.25 (1.8)	-0.07 (0.5)
Sec education	0.06 (0.9)	0.08 (1.2)	0.06 (0.4)	-0.23 (1.7)
Higher education	-0.06 (0.9)	-0.08 (1.2)	-0.04 (0.3)	-0.35 (2.7)*
Single	0.34 (3.0)*	0.21 (2.7)*	0.18 (1.7)	0.41 (3.6)*
Children	-0.46 (3.1)*	-0.21 (2.7)*	-0.34 (2.4)*	-0.41 (2.6)*
Cannabis parents	0.41 (2.6)*	0.62 (4.0)*	0.77 (5.8)*	0.48 (3.1)*
Constant	-2.24 (13.3)*	-2.14 (14.8)*	-1.95 (11.4)*	-1.86 (10.9)*
ρ	0.82 (18.4)*		0.76 (17.8)*	

[a)] Population of 26-50 years; sample of 2288 females and 2038 males; absolute t-values in parentheses; a * indicates that the coefficient is different from zero at a 95% level of significance; the parameter estimates concern dummy variables where the reference group has age 26-30, has a lower education, is non-single, has no children and no parents that previously used cannabis.

Table 4 Predicted use of ecstacy and cocaine(%)[a)]

	Females		Males	
	Ecstacy	Cocaine	Ecstasy	Cocaine
Reference person	0.6	1.1	2.6	3.2
Year 2001	2.8	1.1	6.1	5.6
Age 40	0.2	1.2	2.2	3.7
Single	1.9	2.1	3.8	7.3
Children	0.2	0.8	1.1	1.2
Cannabis parents	3.3	6.7	12.0	8.4

[a)] The reference person has the following characteristics: Year 1994, Age 30, lower education, non-single, no children, no cannabis use parents. The other rows in the table present drugs use numbers if one of the characteristics of the reference person is changed. The predictions are based on the parameter estimates of Table 3.

Figure 1a Lifetime prevalence cocaine by age - females (%)

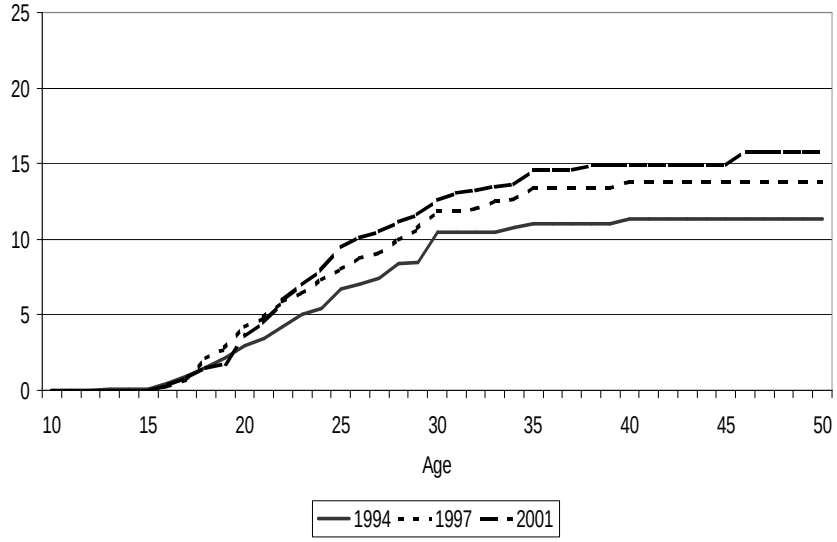

Figure 1b Lifetime prevalence ecstacy by age - females (%)

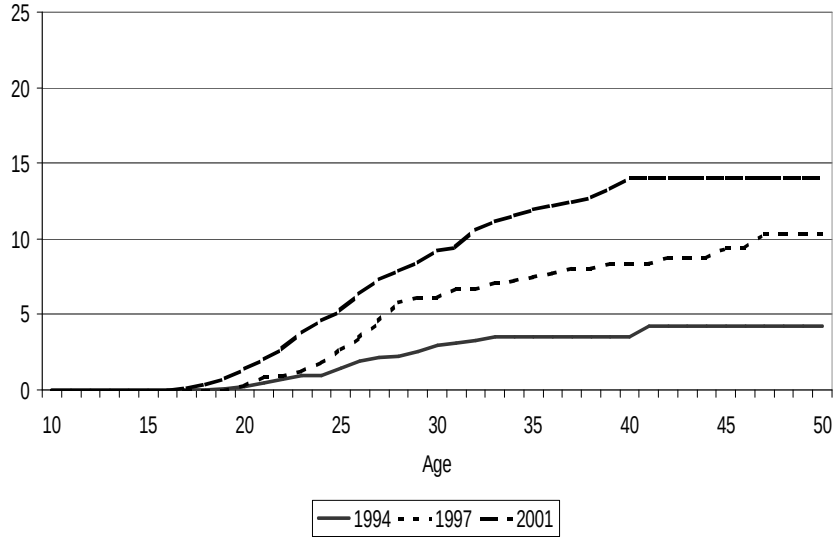

Figure 2a Lifetime prevalence cocaine by age - males (%)

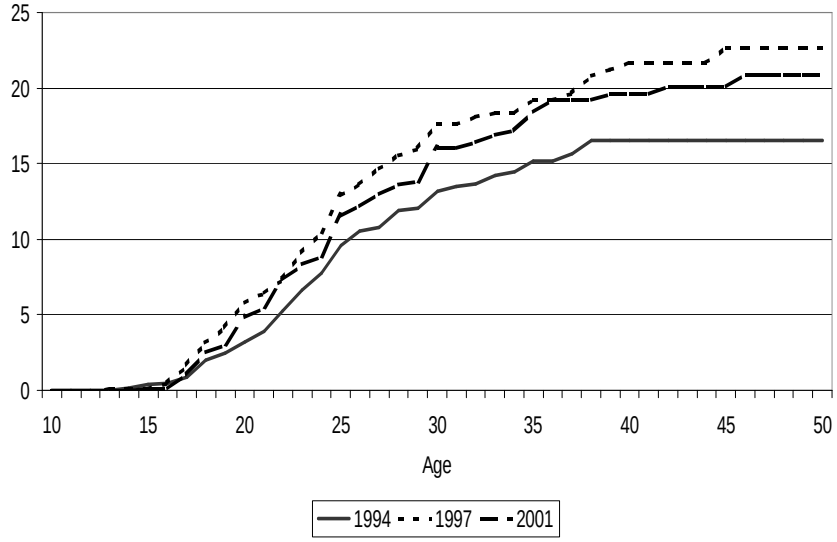

Figure 2b Lifetime prevalence ecstacy by age - males (%)